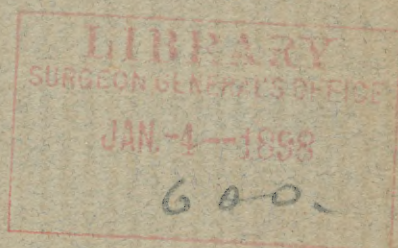


Mac Callum (W.G.)

ON THE HÆMATOZOAN INFECTIONS OF BIRDS.

BY W. G. MACCALLUM, M. D. (Johns Hopkins),  
*Johns Hopkins Hospital, Baltimore.*

*presented by the author*









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## ON THE HÆMATOZOAN INFECTIONS OF BIRDS.

BY W. G. MACCALLUM, M. D. (Johns Hopkins),  
*Johns Hopkins Hospital, Baltimore.*

In the adult examples of the *Halteridium* of Labbé, which occurs abundantly in crows in Ontario, Opie in 1896-7 pointed out a distinction between two forms—a hyaline, non-staining form, and a form which is granular and takes on a comparatively dark stain with methylene blue—and suggested that the hyaline form alone might become flagellated. This distinction is readily confirmed, and it is a fact that only the hyaline forms become flagellated, the granular forms being extruded, and lying quiet as spheres beside the free nuclei of the red corpuscles which lately contained them.

Motile fusiform bodies, identical with the "Vermiculus" described by Danilewsky in his "*Parasitologie comparée du Sang*," in 1889, are seen after fifteen or twenty-five minutes to develop from these quiet spheres and wander away. By careful watching of the two adult forms on extrusion from the corpuscle, it is seen that the flagella from the flagellated forms, tearing themselves free, constitute themselves fertilizing agents or spermatozoa, and proceeding directly to the granular sphere, wriggle about it. One only of these gains admission, and plunges itself into the sphere, which after some agitation of the pigment becomes quiet for a period of fifteen or twenty-five minutes, after which it puts out a conical process, which grows and draws the protoplasm into itself, until we finally have the fusiform body with a small pigmented appendage and refractive, nucleus-like body such as was described by Danilewsky as a "Vermiculus." The origin of the vermiculus is in every case exactly the same.

In other words, we have a sexual process with a resulting motile form, occurring under unfavorable circumstances, and

comparable with analogous processes observed in the lower plants and animals.

It is thought that a similar process may be expected in the case of the human malaria.

The vermiculus moves actively and has great powers of penetration by means of its pointed anterior end, with which it breaks up the red corpuscles in its path, and it is thought that possibly it may penetrate the intestinal wall and escape as the resistant form which gains the external world. This idea is supported by the finding of free organisms in the mucous contents of the intestine.

In the organs, the connective tissue skeleton is one great storehouse of pigment, the branching cells being often loaded with foreign material. The endothelial cells are also very generally pigmented, and there occur in some of the organs, as well as in their blood-vessels, large makrophages loaded with pigment and other debris. Many large phagocytic cells occur in various organs which engulf whole corpuscles with their contained organisms.

The organs found pigmented are, in the order of intensity of pigmentation, the spleen, liver, bone-marrow, intestine, kidney, adrenals and thyroid. The leucocytes take but little part in phagocytosis in the organs, although phagocytosis goes on actively in a slide of blood.

During the last week I have examined the blood of a woman suffering from an infection with the æstivo-autumnal type of organism, in which a great number of crescents were to be seen. These in a freshly made slide of blood, with very few exceptions, retained their crescentic shape for only a few minutes. They soon drew themselves up, thus straightening out the curve of the crescent while shortening themselves into the well-known ovoid form. After the lapse of 10 to 12 minutes most of them were quite round and extra-corpuscular, the "bib" lying beside them as a delicate circle or "shadow" of the red corpuscle.

After 20 to 25 minutes certain ones of these spherical forms became flagellated; others, and especially those in which the pigment formed a definite ring and was not diffused throughout the organism, remained quiet and did not become flagellated. In a field where an example of each form could be watched,



the flagella broke from the flagellated form and struggled about among the corpuscles, finally approaching the quiet spherical form; one of them entered, agitating the pigment greatly, sometimes spinning the ring about. The rest were refused admission, but swarmed about, beating their heads against the wall of the organism. This occurred after 35 to 45 minutes.

After the entrance of the flagellum the organism again became quiet and rather swollen, but although in the two instances in which this process was traced the fertilized form was watched for a long time, no form analogous to the "vermiculus" was seen.

This is evidently for the human being what was foreshadowed by the organisms of the bird.

(In part an abstract of a paper read before the British Association for the Advancement of Science, August 24, 1897, and shortly to appear, *in extenso*, in the Journal of Experimental Medicine.)









